Subject: RTM Database Standards and Procedures SE-1-004

SUPERSEDES SE-1-004 dated 20 December 1995.

AUTHORIZING 201-SE1-001-002, System Engineering Plan

DOCUMENT` REFERENCE
301-CD-002-003, System Implementation Plan
PI CM-1-003, Configuration Change Request Preparation
PI CM-1-004, ECS Change Control Board Process
ECS RTM User Training Guide
RTM User Manual

PURPOSE To insure data integrity and change control of all ECS Requirements in the RTM database.

APPLICABLE TO All ECS Participating Offices including subcontractor personnel

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Introduction

The scope of this document is to define the standard and procedures for requirements management on the ECS project. The tool used to facilitate requirements management is Requirements & Traceability Management (RTM) by GEC Marconi Limited. This document defines the process that must be followed for implementing additions and changes to requirements stored in RTM.

Scope

The RTM standards and procedures document defines the process that must be followed for implementing additions, deletions, and changes to requirements stored in the RTM database. This document focuses on how the ECS requirements in RTM are integrated with the overall Configuration Control Board process. Any seemingly cumbersome steps in the process have been deemed necessary from lessons learned.

It is not intended that the user read the document in its entirety from beginning to end. The document has been designed into 4 layers. It is recommended that the user read in detail Part I "RTM Change Control process" and then review the other parts as the user participates in the process. The remaining parts provide further details about the process steps in Part I. Depending upon the role of the user, different sections need to be reviewed at different times.

Part I	RTM Change Control Process	Describes the RTM Change Control (CCR) process from beginning to end.
Part II	RTM Tool	Describes the RTM Tool
Part III	RTM Design Standards & Rules	Describes the rules of the RTM tool for the ECS environment

Part IV	Process Instruction for Each Key Process Role	Describes the process from the perspective of each key process role. This section focuses on the specific activities which need to be performed by each key role in the process.

1.0 RTM Database Change Control

1.1 Overview of RTM Database Change Control Process and Responsibilities

All requirements changes in RTM are controlled by the ECS Change Control Board (CCB). All potential RTM changes must be previewed to the ECS CCB, which will determine whether to issue an action item to prepare and submit a change request. No modifications to the RTM database are made until a change request has been approved by the ECS CCB. The ECS CCB process is described in PI CM-1-004.

In order to make a change to any requirement class in RTM the following four-phase change-control process must be followed:

I. CCR Initiation/Preparation
II. CCB Review/Approval
III. CCR Implementation
IV. QA/CCR Closure

Figures 1.2.1-1 through 1.2.4-1 are process flow charts summarizing these Phases. Each process flow chart will be followed by accompanying text describing each step. Each of the steps in the process must be completed in sequence.

*IMPORTANT***:** No matter what the source of the change, this RTM Process must be followed. Even in the event of a 'rush situation' all elements of this process must be fulfilled. This is because, any short cuts taken or steps ignored may corrupt the integrity of the database. Even the smallest missed step in following procedures at this point will become difficult to manage later in the process.

The four phase change control process intentionally crosses many different departments within the ECS organization. It is important that the roles of each of the key players is well defined. Potentially six or more people are involved in a single requirement change. Listed below are the key roles and responsibilities required for making a requirement change for this process:

Originator - the person technically responsible for identifying and analyzing the need for a requirement change. This person develops and submits the CCR. Even the smallest missed step in following procedures at this point will become difficult to manage later in the process.

Coordinator - this person is responsible for the CCR from the point of approval at the CCB through the implementation and closure phase. The coordinator is assigned by the CCB and will usually be the originator.

Configuration Management Organization (CMO) Rep.- The CMO will collect all information from the originator, ensure adherence to the process, and provide access for review of the ECS CCRs through use of the ECS CCB Bulletin Board (url http://dmserver.gsfc.nasa.gov/CCB-BB/ECS/ecsbbdex.html).

RTM Database Administrator (DBA)- The DBA provides access privileges needed for users to access the tool via request from the System Management Office (SMO). Once the CCR work has been completed and QAed, the DBA will receive notification from the coordinator and revoke update accesses. If requested via a CCR, to update the RTM schema and attribute definitions in the RTM database, the DBA will be assigned to coordinate and perform the required changes.

*RTM Administrato*r - This person from SMO will ensure process adherence, provide technical guidance of the requirements change impacts at a system level, and provide support on the use of the RTM tool to track requirements. The RTM Administrator also schedules implementation and has the responsibility to advise the ECS CCB on scheduling when RTM action items are being assigned.

Quality Office Rep- QO will ensure process adherence, verify CCR implementation, and provide periodic integrity audits of the database.

RTM Support Personnel - These personnel are responsible for entering the changes in the approved CCR into RTM under the direction of the RTM Administrator. The RTM Support Personnel are members of SMO RTM support group.

Reviewer - This critical role is filled by ECS CCB delegates. Each delegate must ensure a thorough review and impact analysis of the CCR for his/her organization and is responsible for obtaining the review of other members of his/her organization as needed.

The specific responsibilities and sequence of the process events is described in the proceeding Sections 1.2.1 -1.2.4 with corresponding process figures.

1.2 Change Control Phase Process

1.2.1 Phase I - CCR Initiation/Preparation by Originator (Pre-CCB)

The CCR initiation and preparation is performed by the Originator and includes five steps. This first phase is graphically presented in Figure 1.2.1-1. The following provides the details of Phase I.

Phase I, Step 1. Identify Need for Requirements Modification

The first step is to find if there is a need to change any requirements content or the link between requirements. The assessment of a requirement change must be performed from the latest baseline. This change could be identified for many reasons including finding inconsistent or conflicting data in the RTM database.

Phase I, Step 2. Preview Presentation

Once the originator identifies a need for a change to a requirement(s), he/she should contact CMO to schedule a preview presentation. This presentation outlines the scope of the change and estimates the effort needed to investigate and recommend resolution. If the change is deemed valid, the CCB assigns an action item to create a CCR along with a projected board date. The CCB schedules the CCR to assure that all work can be done against a single baseline and deltas between submittal and implementation are kept at a minimum.

The ECS CCB will issue an action item for initiation of a CCR (for changes to requirements) in RTM when, for example:

- GSFC has issued a contract modification authorizing implementation of a level 3 requirements change.
- Technical analysis has revealed the need to change one or more level 4 requirements or change an attribute and/or links in the RBR.
- GSFC has issued an IRD change.
- An attribute needs to be added to an RTM class.
- Inconsistent or conflicting data has been found in the database.
- A database audit has been completed by QO and errors have been discovered.

Phase I, Step 3. Develop Originator Query Set

The Originator develops the Originator Query Set, which is taken from the current baseline version of RTM. The first step is 'generating the Query Statement and querying the current RTM baseline' to extract those requirements subject to modification as addressed in the preview presentation. The Originator includes a copy of the Query Statement with the CCR package for reference. Table 1.2.1-1 in Phase I, Step 5, defines the content of the CCR package. The ECS RTM User Training Documentation and/or the RTM User Manual provides the necessary information for creating queries.

Once the requirements are extracted from RTM into a report, the Originator determines the recommended change for each requirement.

Phase I, Step 4. Develop Change Tables

After carefully reviewing the RTM reports produced in the previous step, the Originator edits the reports to reflect the exact changes that are required. The instructions for editing and formatting given in Section 1.4 must be followed. This table is used later in the process by the CMO to update the Pending Requirements Change Report (PRCR). Therefore, to avoid compatibility problems, the instructions for editing and formatting provided in Section 1.4 must be followed. The Originator includes a copy of the changed tables with the CCR package.

The Originator must generate the RTM report in rtf (rich text format) to facilitate importing it into a Word table or Excel spread sheet. Then sort the information into two kinds of tables:

a. Attribute change tables (A separate table should be created for each RTM class that requires an attribute change).

b. Link change tables (A separate table should be created to add and/or delete links between classes (group the additions and group the deletions within the table)).

To mark desired changes, use the following instructions:

a. Use the underline function in Word or Excel to highlight additions.
b. Use the strike-out function in Word or Excel to highlight deletions.

IMPORTANT: If the original data is being replaced, the original data must still appear in the report with a strike out. If the change is an addition, the original data must still appear. This is a key to adequate CCB review and to the RTM data modification accuracy.

Phase I, Step 5. Develop CCR and Associated Package

The final step in Phase I is to prepare the paperwork to be delivered to CMO for submittal to the ECS CCB (See Section 1.5 for detailed instructions for filling out these forms). The package should include the items provided in Table 1.2.1-1.

This package should be submitted to CMO in electronic form to the ECS cc:mail address ECSCM. A hard copy of the CCR form should be signed by the Originator and the Originator's office manager and delivered to CMO. The CCR should be turned into the CCB 10 days prior to the desired CCB date, which was scheduled at the time of the preview presentation.

Form	***Form No. and Location***	***Notes***
Completed ECS Configuration Change Request (CCR) form -signed by Originator and the sponsoring organization's Office Manager.	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: cm01ju95	Be sure to check the 'RTM' box

Query Statement	TBS by Originator	This is the query statement used to create the Originator Query Set report.
Softcopy RTM Change Tables - The Originator query/change table report with recommended redlines -- (See 1.2.1 , Phase I, step 4)	TBS by Originator	Use the rules for creating & redlining the change table provided in Section 1.4 & 13.2. This table will be used by both CCB reviewers, RTM Support Personnel, and QO to implement the CCRs.
CCR Originator's Preliminary Impacts list	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: cm10se95	This form will be used to alert an organization of a possible impact. It is the responsibility of the Originator to assess the impacts and obtain authorizing signatures prior to the CCB
RTM Change Request Form	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: sm01ma95.	Traveler form used to request RTM access, record RTM data modification completion, and record completion of QA.

Table 1.2.1-1 CCR & Associated Package for Phase I

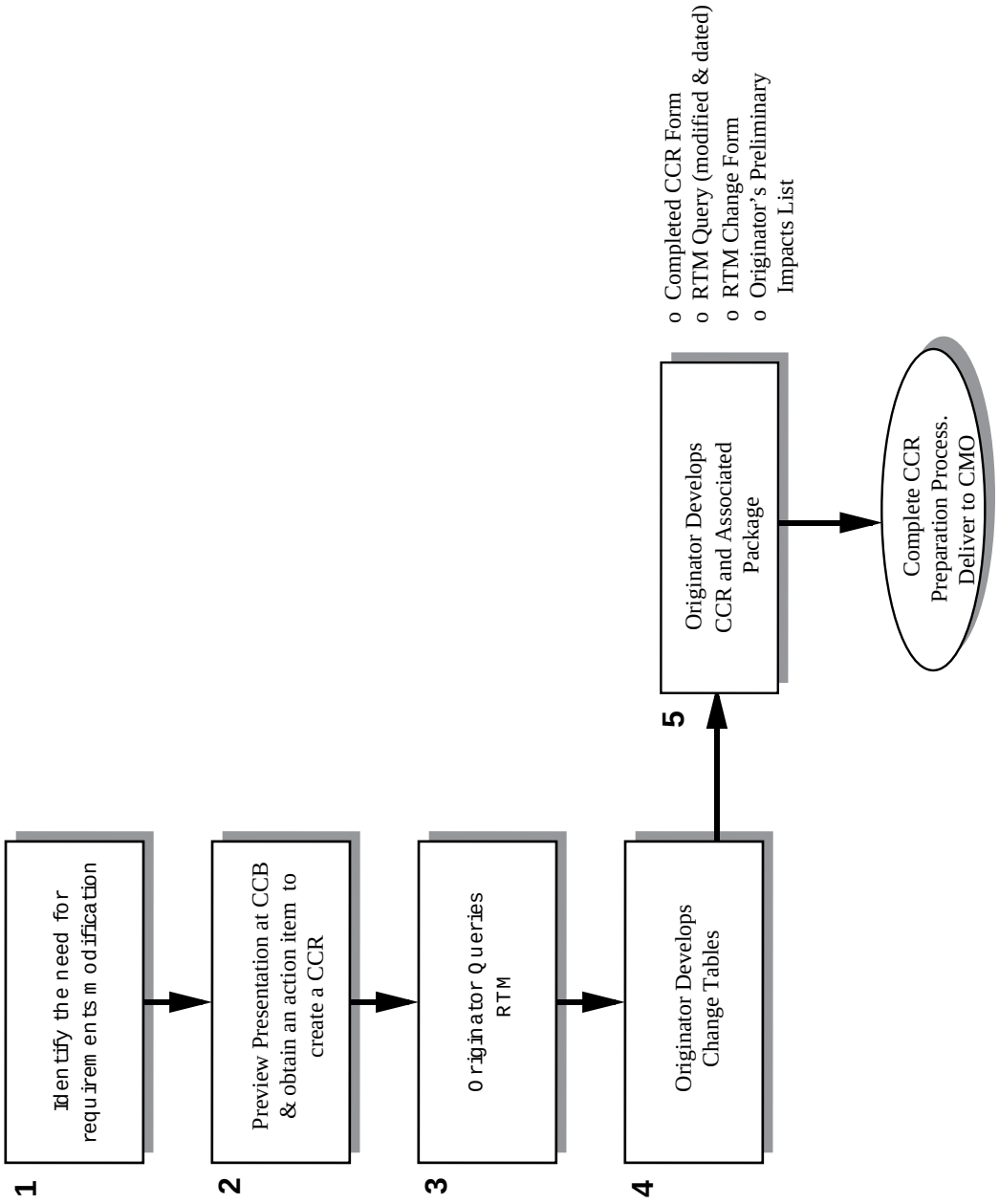


Figure 1.2.1-1 CCR Initiation/Preparation (Phase I)

1.2.2 Phase II - CCB Review/Approval

PI CM-1-004 provides the details of the ECS CCB change control process. The process given here covers the RTM-specific steps.

Phase II, Step 1. CMO Logs the CCR

Once CMO receives the CCR package from the Originator, it will:

a. Assign a CCR number and add the number to all of the items in the CCR package.
b. Place the CCR on an ECS CCB meeting agenda.
c. Close driving Action Item (See Figure 1.2.1-1).

Phase II, Step 2. CMO Posts the CCR for CCB Review

CMO then posts the CCR with its RTM Change Table and associated forms (reference phase 1 step 4) to the ECS CCB Bulletin Board (URL http://dmserver.gsfc.nasa.gov/CCB-BB/ECS/rtmrvdex. html) for review prior to the CCB meeting date. (per timetable in PI CM-1-004).

CMO enters the requirements affected by the CCR in the 'Pending Requirements Change Report (PRCR)'. If a requirement that is recommended for change in the CCR is also requested to be changed in another CCR that is pending, the tool will flag this as a conflict. CMO will inform the originators of each conflicting CCR, by cc:mail that there is a potential conflict with another pending CCR. The pending tool is further defined in Section 1.3.2.3.

Phase II, Step 4. Originator Identifies Potential Impacts

When a match is found in the PRCR, it is the responsibility of the originator to research the related pending CCRs. Once the conflicts are identified, the originator is responsible for contacting the originator(s) of the impacted pending CCRs affecting the same requirement. A resolution of the conflicting pending requirements must be determined prior to the board date of the CCR. *This report can be found on the EDHS home page (URL http://newsroom.hitc.com/rtm/tmdb-ccr.html). Note: the pending requirements changes are listed by class.*

After the identification and resolution of impacts to the CCR, the originator must edit the change recommendation table to reflect any new findings.

Phase II, Step 6. Originator Presents CCRs to the CCB Board

Once the originator makes all necessary corrections (if any) the CCR is then presented to the CCB for review and approval. The revision may have to be posted for further CCB review before disposition.

Phase II, Step 7. CCB Approves CCR and Assigns a Coordinator

When the ECS CCB approves the CCR, it will issue an action item that sets a completion date and assigns a Coordinator to manage the CCR implementation, through completion of the process.

Phase II, Step 8. CMO Distributes Copies of Approved CCR

As soon as the approval signature is obtained, CMO distributes copies of the approved CCR to the following:

a. The assigned CCR Coordinator
b. The RTM DBA
c. SMO RTM Administrator

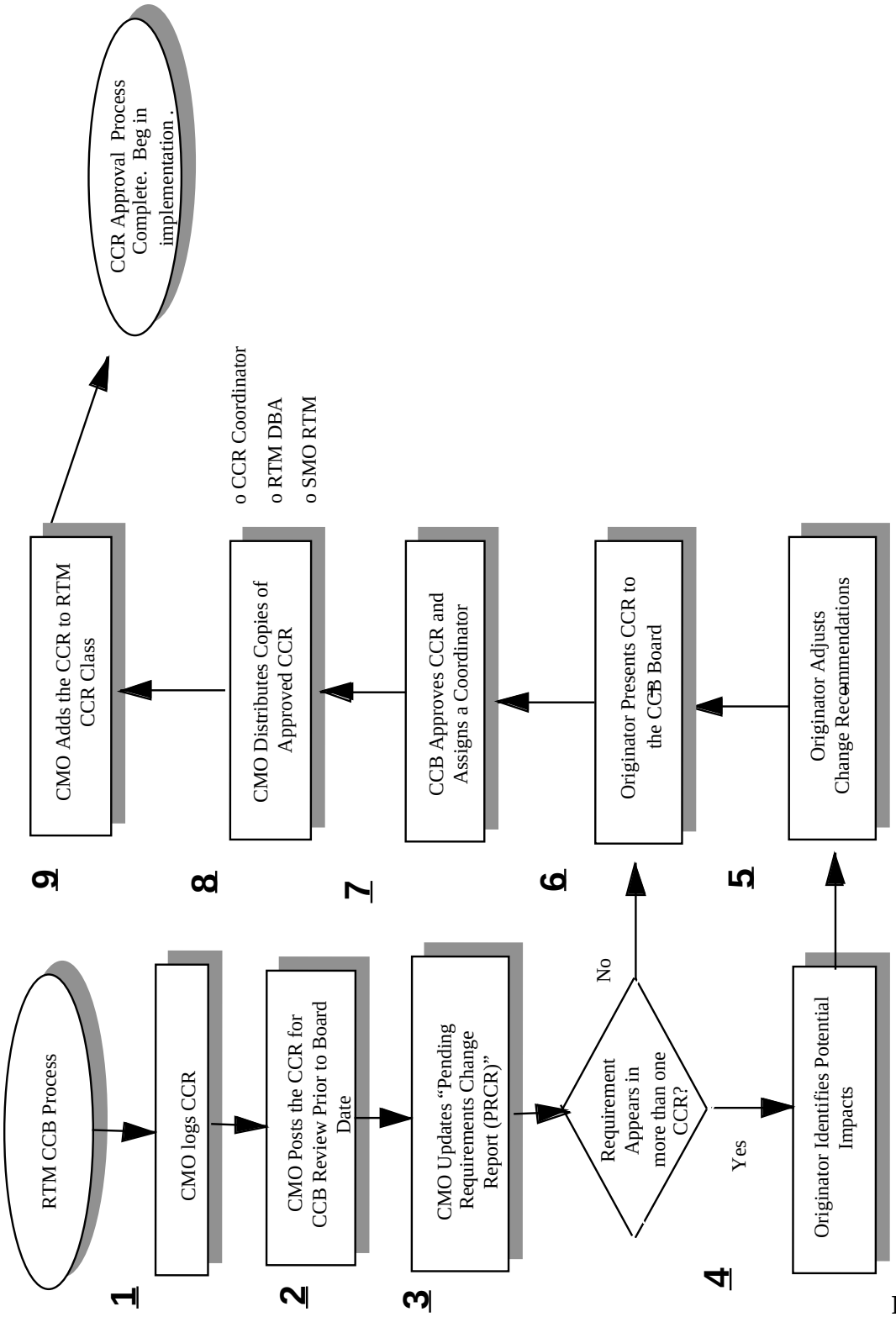


Figure 1.2.2-1

CCB Review/Approval (Phase II)

Phase II, Step 9. CMO Adds the CCR to RTM CCR Class

CMO adds CCR metadata to the RTM CCR class. In the CCR class, each CCR is assigned a record. All of the requirements that are affected by the CCR will be linked to this record after the RTM data modification is complete. It should be noted that whenever a requirement is deleted under a CCR the requirement should be listed in the clarification text. This is necessary because deleted requirements can not be linked. The CCR RTM attributes that must be filled out in RTM are:

a. CCR title
b. CCR Originator
c. CCB Name
d. CCR approval date
e. CCR ID
f. CCR Revision
g. Entry Status
h. GSFC CCR and contract mod information if applicable

1.2.3 Phase III - CCR Implementation Process (Post-CCB)

Phase III, Step 1. SMO RTM Administrator Schedules Work with Coordinator(s)

If scheduling the CCR affects any other CCRs currently in process, the Administrator will ensure that schedule impacts are discussed with the other coordinator(s).

Phase III, Step 2. SMO Makes RTM Data Modification Assignment

Once an approved copy of the CCR is received from CMO, the SMO assigns the RTM Support Personnel to enter the requirements changes specified by the CCR.. The coordinator should work closely with the RTM Support Personnel and be available for any questions.

Phase III, Step 3. RTM DBA Releases Authorization for RTM Data Modification

The SMO authorizes the RTM DBA to allow RTM data modification, gives the package to the assigned RTM Support Personnel and alerts QO when the CCR will be ready for QO.
The RTM Support Personnel will be provided write, create and/or delete access by the RTM DBA to conduct RTM data modification into the appropriate RTM class as authorized by the approved CCR.

Phase III, Step 4. Execute RTM Data Modification and Proofreading

Upon completion of RTM data modification, the RTM Support Personnel will go back through and proof all changes prior to informing the CCR Coordinator of the task completion.

The RTM Support Personnel must go through the following four steps:

a. Make all attribute changes from text change table of the approved Change Table Set
b. Make all link additions/deletions from the link table of the approved Change Table Set
c. Proof all modifications in RTM. This is a critical step, so it is important that the coordinator allow time for this check.
d. Create links to the CCR Class.

Phase III, Step 5. RTM Support Personnel Create Links From the Changed Requirements to the CCR Class

Links must be created from every requirement changed by the CCR to the CCR object within the CCR class. If the change is an attribute change only, then link that paragraph_id to the CCR_ID in the CCR class which authorized the change. If the change is a deletion/ addition of links between classes, then the CCR link should be made to the parent requirement where a link change occurred. It should be noted that whenever a requirement is deleted under a CCR the requirement should be listed in the clarification text.

By using the attribute change & link change tables in the approved change Table Set (2), the paragraph_id can be cut & pasted into an automated link table.

Phase III, Step 6. Coordinator Notifies CMO and QO That RTM Data Modification Is Complete

As soon as the RTM data modification is complete, the Coordinator notifies CMO via cc mail address ECSCM that the RTM data modification is complete. CMO immediately updates this status into the RTM CCR class. The Coordinator forwards the CCR package to QO for verification. The package should include the same items as the initial CCR package as well as a copy of the change table with the RTM Support Personnel's notes. Table 1.2.3-1 illustrates the forms associated with the CCRs at this point.

Form	***Form No. and Location***	***Notes***
Completed ECS Configuration Change Request (CCR) form -signed by Originator and the sponsoring organization's Office Manager.	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: cm01ju95	Be sure to check the 'RTM' box
Query Statement	TBS by Originator	This is the query statement used to create the Originator Query Set report.
Softcopy RTM Change Tables - The Originator query/change table report with recommended redlines -- (See 1.2.1 , Phase I, step 4)	TBS by Originator	Use the rules for creating & redlining the change table provided in Section 1.4 & 13.2. This table will be used by both CCB reviewers, RTM Support Personnel, and QO to implement the CCRs.
CCR Originator's Preliminary Impacts list	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: cm10se95	This form will be used to alert an organization of a possible impact. It is the responsibility of the Originator to assess the impacts and obtain authorizing signatures prior to the CCB
RTM Change Request Form	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: sm01ma95.	Traveler form used to request RTM access, record RTM data modification completion, and record completion of QA.

Redlined Change table with RTM Support Personnel's notes	TBS by RTM Support Personnel	RTM Support Personnel's explanatory notes and the old & new requirement Key Nos.

Table 1.2.3-1 CCR & Associated Package for Phase III

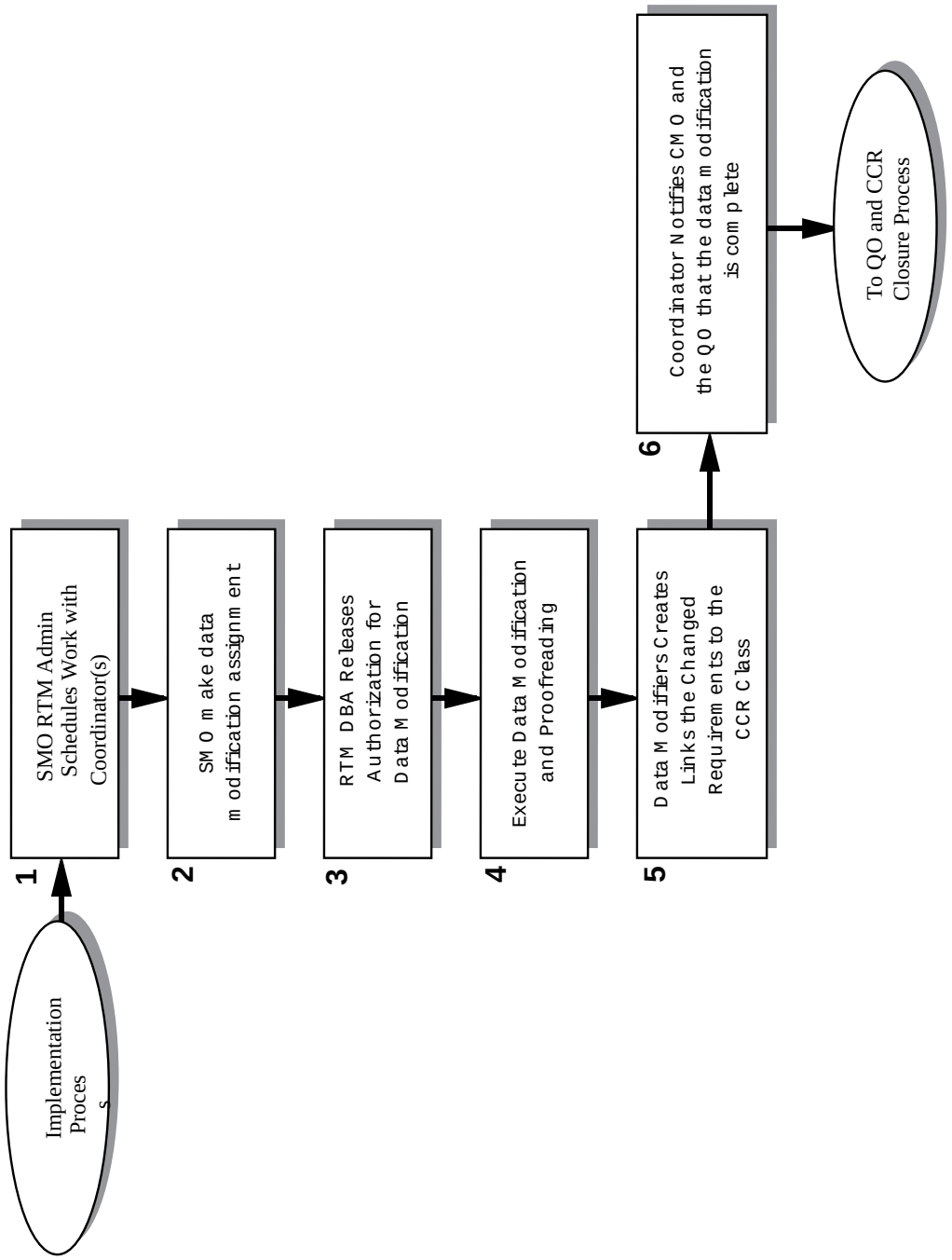


Figure 1.2.3-1 CCR Implementation (Phase III)

1.2.4 Phase IV-- QO and CCR Closure Process

Phase IV, Step 1. QO Runs the RTM QO Query (Post-RTM data modification)

At this point in the process, it is important to obtain a current time-stamped snapshot of the database. QO queries RTM for the present post-RTM data modification condition.
QO will run the QO Query to be compared to the Originator Query Set from Phase I, to verify the CCR implementation. In some cases QO will determine it preferable to write its own query.

Phase IV, Step 2. QO Verifies CCR Implementation, Product and Process
QO verifies the proper implementation of the CCR. If there are impacts to other areas based on the CCR implementation, this is the last stage where problems can be caught.

a. QO will use the approved CCR change tables along with the QO query to verify the implementation of the CCR.
b. QO will verify the links to the CCR class
c. QO will review the requirements directly in the tool to identify discrepancies.
d. QO will document any identified deficiencies and provide a list to the Coordinator for resolution. This list should also be added to the CCR package for reference.
e. If any impacts require action outside the scope of the CCR, QO will note the impact as an action on the RTM form.

Phase IV, Step 3. Coordinator/RTM Support Personnel Make Corrections Per QO's List
If corrections are not necessary, this step will be omitted. If changes are needed, the CCR goes back to the coordinator for further RTM data modification. Once RTM Support Personnel resolve QO's issues, the CCR folder is returned to QO for reverification.

Phase IV, Step 4. QO Signs RTM Change Form and Forwards Package to Coordinator.
The completed CCR package should include the items provided in table below.

Form	***Form No. and Location***	***Notes***
Completed ECS Configuration Change Request (CCR) form -signed by Originator and the sponsoring organization's Office Manager.	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: cm01ju95	Be sure to check the 'RTM' box
Query Statement	TBS by Originator	This is the query statement used to create the Originator Query Set report.

Form	*Form No. and Location*	*Notes*
Softcopy RTM Change Tables - The Originator query/change table report with recommended redlines -- (See 1.2.1 , Phase I, step 4)	TBS by Originator	Use the rules for creating & redlining the change table provided in Section 1.4 & 13.2. This table will be used by both CCB reviewers, RTM Support Personnel, and QO to implement the CCRs.
CCR Originator's Preliminary Impacts list	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: cm10se95	This form will be used to alert an organization of a possible impact. It is the responsibility of the Originator to assess the impacts and obtain authorizing signatures prior to the CCB
RTM Change Request Form	URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html Form No.: sm01ma95.	Traveler form used to request RTM access, record RTM data modification completion, and record completion of QA.
Redlined Change table with RTM Support Personnel's notes	TBS by RTM Support Personnel	RTM Support Personnel's explanatory notes and the old & new requirement Key Nos..
QO's Actions Report	TBS by QO	This report points out a need for more requirement changes outside the scope of the CCR (new CCR required). The Coordinator is responsible for reporting the need to the ECS CCB.

Table 1.2.4-1 CCR & Associated Package for Phase IV

Phase IV, Step 5. Coordinator Initiates the CCR Closure Process
The Coordinator immediately takes three actions:

a. Forwards the complete CCR package to CMO.
b. Notifies the RTM DBA to revoke RTM data modification authorization.

c. Notifies the RTM SMO Administrator that the database is ready for new CCR data-entry.

Phase IV, Step 6. RTM DBA Revokes RTM Data Modification Authorization and Notifies CMO

RTM DBA removes all RTM access privileges associated with the CCR.

Phase IV, Step 7. SMO RTM Administrator Directs Start of Next CCR Data Entry

Upon receiving revoke access completion notification from RTM DBA, SMO RTM administrator directs start of next CCR RTM data modification.

Phase IV, Step 8. CMO Closes the CCR

When CMO has received the complete package with QO's signature, the CCR is officially implemented and can be closed. The following events must take place:

a. RTM CCR Class is updated to QA Completed status.
b. CMO verifies that RTM DBA has revoked RTM data modification authorization.
c. The CCB's CCR Implementation action item is closed.
d. CMO adds the list of deleted requirements to the clarification text of the CCR class.
e. The CCR is closed in the CCR tracking system.
f. The CCR closure is reported with the next Baseline documentation.
g. The CCR is removed from the Pending Requirements Change report at the next baseline.

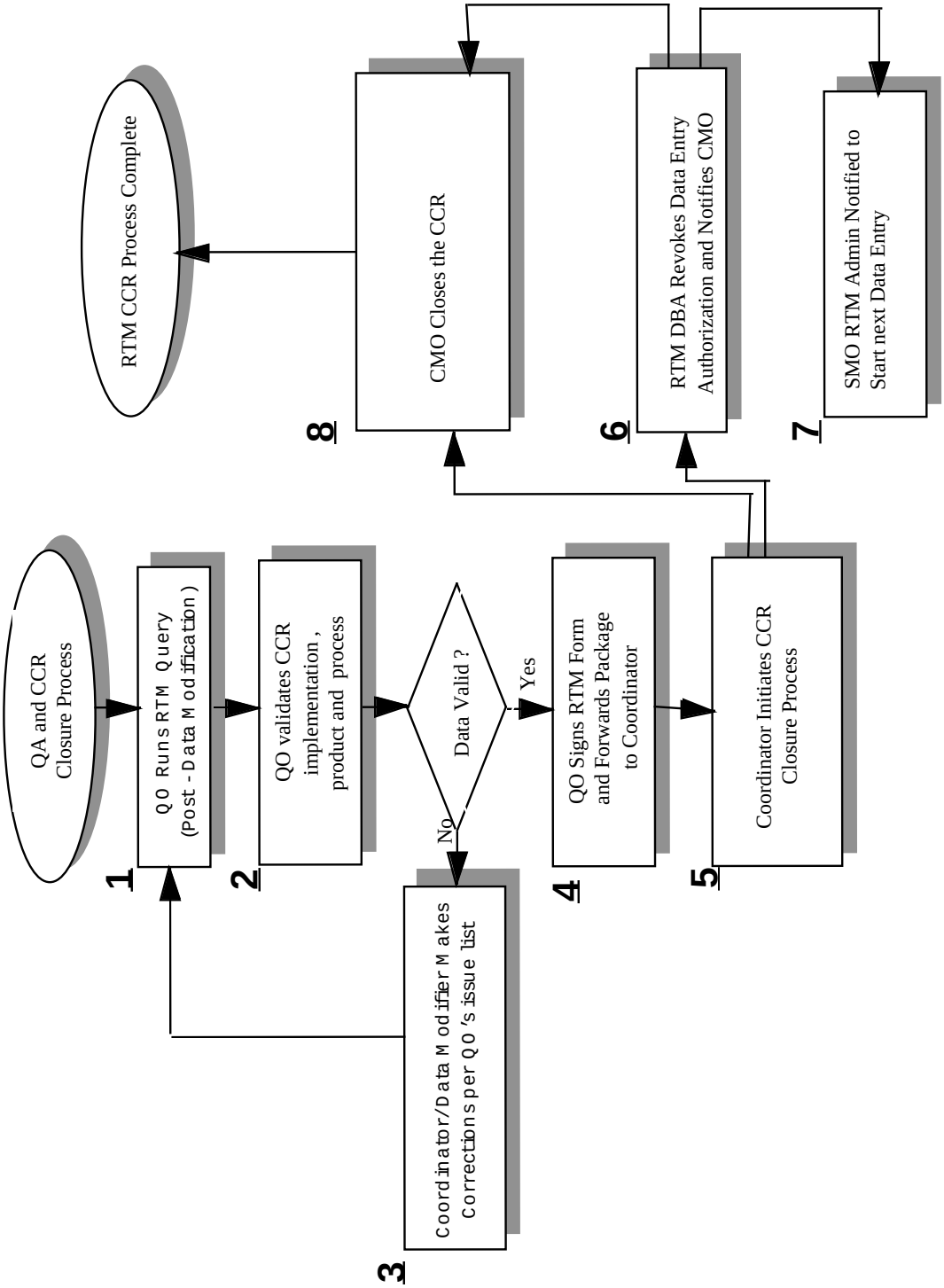


Figure 1.2.4-1 QO and CCR Closure (Phase IV)

1.2.5 RTM Process Checklist

RTM Change Process Checklist

CCR #:	CCR Title:	
CCB Date:	Deferred Date:	
TASK DESCRIPTION (See RTM PI SE-1-004)	DATE COMPLETED	ACTIONEE
PHASE I - CCR Initiation/Preparation (Pre-CCB)		
1. Preview Presentation		
2. Originator Queries RTM (Originator Query Set)		
3. Originator Develops Change Tables		
4. Originator Develops CCR and Associated Package		
PHASE II - CCB Review/Approval		
1. CMO Logs the CCR		
2. CMO Posts the CCR for CCB Review		
3. CMO Updates "Pending Requirements Change Report (PRCR)"		
4. Originator Identifies Potential Impacts		
5. Originator Adjusts Change Recommendations		
6. Originator Presents CCRs to the CCB Board		
7. CCB Approves the CCR and Assigns a Coordinator		
8. CMO Distributes Copies of Approved CCR		
9. CMO Adds the CCR to RTM CCR Class		
PHASE III - CCR Implementation Process (Post-CCB)		
1. SMO RTM Administrator Schedules Work with Coordinator(s)		
2. Coordinator Makes Data Entry Assignment & Notifies RTM DBA		
3. RTM DBA Releases Authorization for Data Entry		
4. Execute Data Entry and Proofreading		
5. Data Entry Creates Links From the Changed Requirements to the CCR Class		
6. Coordinator Notifies CMO and QO that Data Entry is Complete		
PHASE IV - QO and CCR Closure Process		
1. QO Runs RTM QO Query (Post-Data Entry)		
2. QO Verifies CCR Implementation, Product, and Process		
3. Coordinator/Data Entry Make Corrections Per QO's List		
4. QO Signs RTM Change Form and Forwards Package to Coordinator		

5. Coordinator Initiates the CCR Closure Process		
6. RTM DBA Revokes Data Entry Authorization and Notifies CMO		
7. SMO RTM Administrator Directs Start of Next CCR Data Entry		
8. CMO Closes the CCR		

CM11SE95

ECS

The checklist can be used to review the progress of the process. All items should be complete. The Originator can start the use of this checklist and attach it to the CCR file for use by the other key participants in the process. A clean copy of this checklist can be found on the EDHS - Internal Server - Project Forms (URL: http://dmserver.gsfc.nasa.gov/forms/formindex.html, Form No: cm11se95)

1.3 Description of Methods for monitoring ECS RTM CCRs and Requirements Management Activity

No matter what your role is in this Requirements Tracking and Change Process, it is key that you are cognizant of the state of the ECS requirement in RTM. There are two versions of the RTM database and many different reports and tools which help the user assess the state of the ECS requirements. The preceding sections describe the content, location, and purpose of those tools.

1.3.1 Description of RTM Requirements Databases in RTM- "VERSIONmmddyy" vs "MAIN"

At any given time there are at least two versions of the ECS requirements in RTM. They are called “MAIN” and “VERSIONmmddyy”.

1.3.1.1 MAIN Database

MAIN database is the ECS requirement’s production database. All RTM CCRs are applied to MAIN database. ECS CCB is the only organization that can authorize updates to MAIN database via approved CCRs. Once a CCR is approved by the ECS CCB, update access to MAIN database is open to the editor and access is revoked when that CCR is complete and signed off by QO. This process of controlling access to MAIN database is also described in more detail throughout this PI. Because MAIN database is only used to apply CCRs, it contains up-to-date status of ECS requirements.

1.3.1.2 VERSIONmmddyy Database

VERSIONmmddyy database is the snapshot of MAIN database as of mmddyy date. VERSIONmmddyy database is created either when a major review (PDR, CDR) occurs or when a major CCR or a group of CCRs has been applied to MAIN database. Once created, VERSIONmmddyy database is used for query only. That means all update privileges are revoked so that all organizations (QO, IV&V, GSFC, Release organizations) can refer to this same read-only database to verify their activities and start the next set of change activities. Figure 1.3.1.2-1 RTM Baselining Process, visually describes the relationship between MAIN and

VERSIONmmddyy databases and provides the characteristics of each. Note that when a VERSION of the datebase is cut at the time of a major project milestone the RTM title will not be VERSIONmmddyy it will be MILESTONE_NAMEmmddyy.

The reports produced on the ECS Requirements home page are extracted from the VERSIONmmddyy database. To see the differences from VERSION to VERSION, users can view the delta report, which is available on the ECS Requirements home page (URL http://newsroom.hitc.com/rtm/tmdb-rtm.html), where you should find a hypertext link named 'delta'. This delta report provides a list of CCRs applied since the last baseline.

1.3.2 RTM Home Page

Users can view the current status of the ECS RTM database via the World Wide Web home pages. The purpose of this home page is to provide users a direct link to the RTM tool and enables them to extract requirements and traceability information from the RTM database.

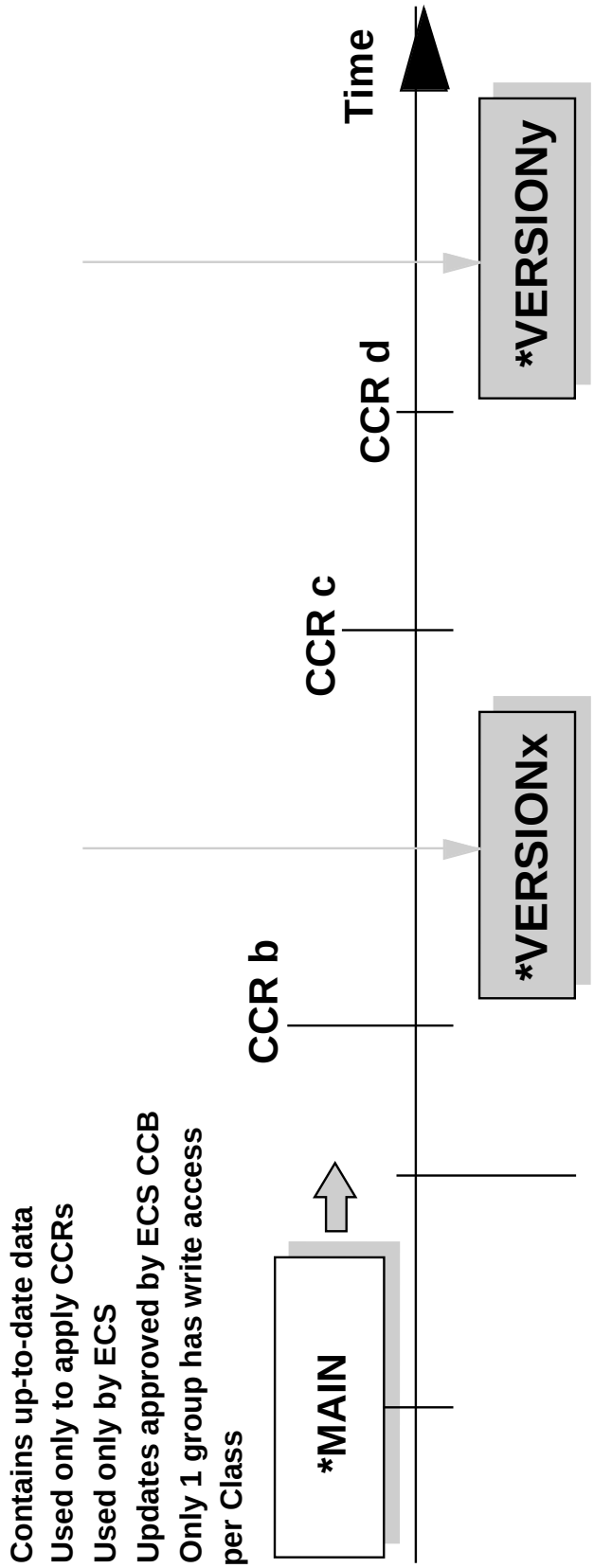
The ECS Requirements home page can be accessed via Mosaic or NetScape using the following universal reference list (url): http://newsroom.hitc.com/rtm/tmdb-rtm.html.

Requirements management activities can be accessed in two areas.

a. First, the "ECS Requirements" WWW home page on the "TMDB" portion of the EDHS home page (URL http://newroom.hitc.com/rtm/tmdb-rtm.html) will be the entry point for the status and viewing current "VERSION" requirements.

b. Second, the ECS CCB Bulletin Board home page, accessible from the Internal Server portion of the EDHS home page (URL http://dmserver.gsfc.nasa.gov/CCB-BB/ECS/escbbdex.html), which describes the CCR activity and disposition of CCRs on a continuous basis. Refer to these home pages for level of detail. The next few sections describe the reports found on the ECS Requirements home page.

1.3.1.1 RTM Baselining Process



- Contains up-to-date data
- Used only to apply CCRs
- Used only by ECS
- Updates approved by ECS CCB
- Only 1 group has write access per Class

- A snapshot of MAIN
- Created when CCR update is complete
- Frozen from updates
- Delivered to IV&V
- Connected to RTM homepage
- Used by internal/external users
- See RTM homepage for change activity

*MAIN and VERSION are different projects maintained in the RTM database

1.3.2.1 Known Issues

Provided in this report is a listing of outstanding issues that are either actions from previous CCRs, new issues developed from further requirements analysis (i.e., periodic queries and audit of the RTM database to highlight deficiencies that require resolution), and issues that may become precursors to issues to be "previewed" at an ECS CCB prior to the implementation of the formal CCR (see topic below).

The list of known issues can be found in the Requirements CCR Reports of the ECS Requirements portion of the EDHS home page, subsection ÔChange ActivityÕ, where there should be a hypertext link titled ÒKnown IssuesÓ (URL http://newsroom.hitc.com/rtm/tmdb-ccr.html). The known issues list should be reviewed prior to initiating a CCR. Future CCRs may be derived from the Known Issues list.

1.3.2.2 CCR Preview Presentations

The next report that can be found on the home page titled Requirement CCR Reports of the ECS Requirements portion of the EDHS home page, subsection “Change Activity”, where there is a hypertext link titled ÒCCR Preview PresentationsÓ(URL http://newsroom.hitc.com/cmo/rtmpre view.html). This contains copies of presentations made to the ECS CCB prior to the issuance of a CCR. The preview presentation are posted here for your information to assist in reducing redundant activity in the requirements analysis area.

1.3.2.3 Pending Requirements Change Report (PRCR)

The RTM Pending Requirements Change Report (PRCR) is an excel workbook maintained by CMO. This file stores a list of all requirements changes that are under the consideration of the ECS CCB board. This is a tool designed to assist the originators in accurately assessing the state of the requirements. When a requirement change is "pending" review by the CCB, it is placed in this file. If another CCR enters the system and references the same requirement, then a flag alerts the user. When CMO enters a CCR into the tool and finds a flagged conflicting requirement, CMO contacts the Originator to resolve the issue.

On the home page titled Requirement CCR Reports of the ECS Requirements portion of the EDHS home page, subsection "Change Activity," there is a hypertext link titled "Pending Requirements Changes” (in PDF Format) broken down by class (URL http://newsroom.hitc.com/rtm/tmdb-ccr.html).

1.3.2.4 Approved RTM CCRs

Full text of the approved RTM CCRs can be found in the Requirements CCR Reports of the ECS Requirements portion of the EDHS home page, subsection ÔChange ActivityÕ, where there should be a hypertext link titled ÒApproved RTM CCRsÓ (URL

http://newsroom.hitc.com/cmo/rtmdex.html). Hypertext links allow the user to review the CCR forms and all associated change tables.

1.4 Creating the Standard CCR Change Table Set

1.4.1 Basic Attribute Change Query/Table

For any RTM Requirements Change request, the following attributes must be included in the RTM query:

paragraph_id
req. key
req. text
req. interpretation

If the proposed changes address another attribute, that attribute must be added to this base query. No change table will be accepted by CMO without at least a reference to the four attributes listed above from RTM. All columns of the change tables should fit on the whole page. Please make sure no columns run off the edge of the page. The 'paragraph_id' should always be located in the left column. It is important that the text in the 'paragraph_id' column does not wrap around. It is acceptable for the other columns to wrap around. CCRs will be rejected prior to the board date if the format of the tables are not correct.

Use Rules for Redlining this table provided in Phase I, step 4. They are repeated below for your convenience:

Generate the RTM report in rtf (rich text format) to facilitate importing it into a Word table or Excel spread sheet. Then sort the information into two kinds of tables:

a. One table should be made for each RTM class that requires an attribute change.

b. A separate table should be created to add and/or delete links between classes (group the adds and group the deletes).

After carefully reviewing the RTM report, the Originator edits the RTM report to reflect the exact changes that will be required. The tables should contain only change information. Requirements for which changes are not being proposed must be removed from the tables:

a. Use the underline function in Word or Excel to highlight additions.

b. Use the strike-out function in Word or Excel to highlight deletions.

Editing the report will be a precise process:

a. Bring the RTM report into a Word table or Excel spreadsheet.

b. Use the underline function to highlight additions

c. Use the strike-out function to highlight deletions

IMPORTANT: If the original data is being replaced, the original data must still appear in the report with a strike out. If the change is an addition, the original data must still appear. This is a key to adequate CCB review and to RTM data modification accuracy.

The headings for the tables must provide the following information:

a. The "title" of the query

b. The CCR #

c. The date of the Baseline version of RTM used to create the query

d. The actual date the query was run

e. Include page numbering at the bottom

Table 1.4.1-1 below, is an example of an attribute change table for additions/deletions to attributes within a class (the paragraph_id must always appear all on one line). The table is giving the instructions to add req_interpretation text to SDPS0010 and to remove the req_interpretation from PGS0120 in class L3_FPRS.

paragraph_id	req.key	req. text	req.interpretation
SDPS0010	2	The SMC shall perform fault analysis including, at a minimum: a. Isolation b. Location c. Identification d. Characterization	Semi-automated or automated
PGS0120	3	The PGS shall base the PGS reprocessing plan on, at a minimum: a. Requests received from IMS b. SMC directives c. The standard	~~Semi-automated or automated~~

Table 1.4.1-1 Attribute Change Table Example 1

1.4.2 Changing Links Between Two RTM Classes

The headings for the tables must provide the following information:

a. The "title" of the query

b. The CCR #

c. The date of the Baseline version of RTM used to create the query

d. The actual date the query was run

e. Include page numbering at the bottom

Changes to Link should be illustrated in a link change table that is divided by 'links to be added' and 'links to be deleted.' (see example table below)
Add the following links between RBRs and L4s

PGS-0000#A	C-CSS-00002
PGS-0001#Ir1	C-CSS-00002
IMS-0003#B	C-CSS-00003

Delete the following links between RBRs and L4s

PGS-0000#Ir1	C-CSS-00002
IMS-0001#A	C-CSS-00003

Changes to RTM can be made only if provided in this format and are attached to signed CCR & RTM forms. It is the responsibility of the Coordinator to provide the change table and proper accompanying paper work. However, anyone performing RTM data modification is asked not to accept change tables outside of this format unless the Coordinator documents the reason for the variation from standard. This will assist QO in validating the changes.

1.4.3 Creating Links to the CCR Class

Links must be created from every requirement changed to the CCR in the CCR class which authorized the change. If the change is an attribute change only, then link that paragraph_id to the CCR_id in the CCR class which authorized the change. If the change is a deletion/ addition of links between classes, then the CCR link should be made to the parent requirement where a link change occurred.

By using the approved change tables, the paragraph_ids can be cut & pasted into an automated link table. The current instructions for automating links can be found in Section 8.3.

Either the RTM Support Personnel or the Coordinator can create these links. It is ultimately the responsibility of the Coordinator to have the links created and QA'ed.

1.5 Directions for Forms in a Complete CCR Package

To promote frequent, timely maintenance of both the forms and this document, forms will not be integrated into this document. Forms are found in the Internal Server portion of the EDHS home page (URL http://dmserver.gsfc.nasa.gov/forms/formindex.html).

Instructions for the CCR form itself can be found in the Internal Server portion of the EDHS home page (URL http://dmserver.gsfc.nasa.gov/forms/formindex.html, Instruction No.: cm01jl94.wrd, CCR form number is cm01ju95). The key element in the RTM process is to fill in the block titled "Source." In this block, place the CCB/RTM action item number that authorized the initiation of the CCR.

1.5.1 RTM Change Request Form

This form travels with RTM requirements change CCRs and is updated at each phase in the process. The first block is filled out by the Originator, the 2nd block is completed by the Coordinator, the 3rd block is filled out by the RTM Support Personnel and finally the 4th block is completed by QO. Table 1.5.1-1 provides a description for each field of the RTM Change Request Form.

The form is located in the Internal Server portion of the EDHS home page (URL http://dmserver.gsfc.nasa.gov/forms/formindex.html, Form No.: sm01ma95).

Today's Date:	Enter date of CCR submittal
Authorizing CCR Number:	CCR number will be assigned by CMO when it logs the CCR.
Originator:	CCR Originator's name
Schema Impact:	Check this box if the CCR is requesting a change to the RTM schema
Affected RTM Class Name:	Specify the RTM classes that will be affected by the CCR.
Name of Coordinator	Coordinators name as assigned by the CCB.
Date Received:	Enter the date Coordinator receives CCR pkg
General Comment or Instructions:	Enter any special instructions for the RTM Support Personnel here
List of associated text change tables that are attached:	Enter the numbers and names of the text change tables included in the CCR package, if applicable.
List of associated link change tables that are attached:	Enter the numbers and names of the link changes tables included in the CCR package.
Data Entry By:	Enter the name of the RTM Support Personnel here.
Date Received:	Enter the date RTM Support Personnel received CCR pkg
Comments:	Here the RTM Support Personnel should enter any notes regarding the CCR and put his/her initials by the completion date. Also, the Coordinator should note the date on which the CCR is delivered to QO.
Type of Change, Done or N/A, Date	Upon completion, check box, initial and date for each applicable type of change implemented.
QA'ed By:	Enter the name of the QO person performing the verification of the CCR implementation.

Date Received:	Enter the date QA receives CCR pkg
Comments:	This area is for identifying any discrepancies found (a detailed discrepancy report may be attached.). QO may recommend submittal of an additional CCR based on new impacts found during the verification process.
QO Check, Done or N/A, Date	Upon completion, check box, initital and date for each applicable type of change QAed.
QO report attached	Check box to indicate if QO report was or was not included with CCR pkg

Table 1.5.1-1 RTM Change Request Form Field Descriptions

1.5.2 CCR Originator's Preliminary Impacts List

This is a CMO form which will be used to highlight impact to other departments of a requirements change in RTM. The Originator fills out this form and submits it with the CCR when an impact is identified during CCR preparation, Phase I. The originator must obtain the authorized CCB signatures from each organization for which there is a predicted impact, before CCB approval. The form is located in the Internal Server portion of the EDHS home page (URL http://dmserver.gsfc.nasa.gov/forms/formindex.html, Form No.: cm10se05).

For example, the change being recommended may affect other attributes or links in the data base and the Originator must identify all these impacts.

a. If a requirement is being de-allocated from a Release in the RBR class, it is important to highlight this fact to the next release organization, which will be responsible for implementing the functionality of the requirement.

b. In de-allocating from a Release, several level 4 requirements may become orphans. In this case the orphan level 4s must be linked to another RBR as a part of the change request.

Because a single change can have a ripple affect, all possible scenarios must be considered before the CCR is submitted. For example:

a. A change in Release or requirements text may generate a change to requirements interpretation text.

b. A level 3 RBR change may affect up to six other dependent classes (e.g., test, L4s, IRDs).

Part II: RTM Tool

2.0 The RTM Tool

2.1 Hardware and Software Configuration

ECS' RTM runs on the HP 715/50 with HP-UX A.09.01 operating system. The host name is 'aqua' and IP address is 155.157.84.19.

The current version of RTM is V2.3.3. with 10 floating licenses supporting 10 concurrent RTM users. The RTM software supports Motif and runs on top of Oracle relational DBMS V.7.0.16.

3.0 Terminology and Naming Convention

Table 3.0-1 below provides definitions of some terms used in RTM.

ATTRIBUTE	The individual pieces of data which form an object
CLASS	A way to package associated pieces of data together
CONFIGURABLE	A type of attribute that contains a predefined enumerated list of options
FREE TEXT	A type of an attribute that contains free text and is up to 16Kbytes in size
LINK	Is one occurrence of the association defined by a relationship. It links two objects
OBJECT	An instantiation of a class
RELATIONSHIP	Identifies an association between 2 classes
REMNANT	A result output created by the auto_stripper tool
SCRIPT	Contains SQL-like statements used to produce reports

Table 3.0-1 RTM Terminology

3.1 Schema

See ECS cc:Mail Bulletin Board "RTM" [subtitle "RTM Schema and Data Dictionary"] or located in the ECS Requirements of the TMDB portion of the EDHS home page, where there should be a hypertext link titled “Class Definition Diagram” (URL http://newsroom.hitc.com/rtm/tmdb-rtm.html) for latest configuration.

3.2 Data Dictionary

See ECS cc:Mail Bulletin Board "RTM" [subtitle "RTM Schema and Data Dictionary"] or located in the ECS Requirements of the TMDB portion of the EDHS home page, where there should be a hypertext link titled “RTM Data Dictionary (PDF)” (URL http://newsroom.hitc.com/rtm/tmdb-rtm.html) for latest configuration.

4.0 Procedures for Logon/Logout

Users can access the RTM tool from any workstations, SCOs, Xterms, PCs, or Macs. To access from a workstation, SCO, or an Xterm, users need to telnet to aqua. To access from a PC or Mac, users need to have an X-terminal emulation software package, such as eXodus or Xceed, to manage X traffic from the host.

To access RTM, users first need to contact the Help Desk who will configure the users' environment to use the RTM tool. Then follow the most recent instructions on the "RTM" cc:Mail Bulletin Board.

5.0 RTM Administration

5.1 Security Control

Access to RTM Database is controlled by four levels of access: Read, Write, Create, and Delete. The Read access is always granted if requested. The other three level of access are granted only in the following cases:

a. the request is accompanied by an approved CCR

b. the request is approved by the SMO RTM Administrator

Access will be revoked when a CCR is completed. Refer to Section 5 of this document for more detail.

5.2 Problem Reporting

Users should report all RTM problems to the HTSC Help Desk who will log the problem to its problem tracking system. Once a problem is resolved, the user should receive an E-mail notification from the HTSC Help Desk.

5.3 Administration Handbook

An Administration Handbook is also maintained by the DBA. Included in this Handbook is information used by DBA to install, upgrade, and maintain the RTM tool.

5.4 RTM Working Group

Communication among groups regarding RTM activities and issues is provided via the RTM AdHoc Working Group. The group meets as needed to address timely issues on use and population of RTM. The group has representatives from all ECS project organizations: CMO, QO, Release Organizations, FOS, HTSC, SMO, IATO. The group is chaired by the RTM DBA. Minutes of the meetings are posted on the RTM bulletin board.

5.5 RTM Bulletin Board

The cc:Mail's RTM Bulletin Board is another form of communication amongst groups. It contains minutes of the RTM Working Group, meeting notifications, system availability announcements, version upgrade news, tool demonstrations, training schedule, and anything related to RTM that needs to be broadcast to the user community.

Part III: RTM Design Standards and Rules

6.0 Standards for RTM Class Content

6.1 Comments on Current Schema

The current RTM tool schema, the associated attributes, and the data dictionary associated with the present schema can all be accessed on the ECS cc:Mail "RTM" bulletin board or located in the ECS Requirements of the TMDB portion of the EDHS home page, where there should be

hypertext links titled “Class Definition Diagram” and “RTM Data Dictionary (PDF)” (URL http://newsroom.hitc.com/rtm/tmdb-rtm.html).

This schema has evolved in the environment of the RTM WG headed by the RTM DBA. Note that the schema assumes certain attributes as mandatory. This means that an update to a requirement and/or its attributes requires that entries for all mandatory attributes be input, otherwise RTM will not accept an update. Please consult the Data Dictionary (section 3.2 above) for the latest mandatory attributes listed to preclude RTM data modification problems.

Of particular concern is the manner in which L3 RBRs and L4s are defined and related to each other. An extended explanation (beyond what is already in the RTM Data Dictionary) is described below. The items below will be given special scrutiny during the CCB Process in order for requirements changes to be approved. Your special attention to these definitions is recommended.

6.2 L3 RBR (REQ_BY_REL) Class Explanation

This section discusses some important issues regarding the "REQ_BY_REL" Class in RTM and associated attributes. It is meant to augment the descriptions in the RTM Data Dictionary. The attributes are highlighted in **"bold".**

- The L3 RBR Class is a Class derived from the baselined (L3) F&PRS requirements.
- Its purpose is to decompose existing text in the L3 Requirements into requirements that contain identical or subsets of existing L3 text and allocate those resultant requirements to each planned Release.
- The ECS Chief Engineer has directed that there will be no modification of existing L3 text in order to accommodate L3 RBR creation; L3 RBR can only contain excerpts of existing L3 F&PRS text.

A L3 RBR is a complete word-for-word repetition of the text in the L3 F&PRS or a subset. That is, to create a L3 RBR it must not be derived text; it must be text that is truncated or subsetted word-for-word from the original L3 F&PRS text. Words and phrases can be eliminated from the parent L3 to create an RBR; however, the augmentation of Level 3 requirement text with additional words is not allowed. This is best demonstrated in Figures 7.2-1 and 7.2-2.

Some of the present L3 (F&PRS) requirements may be in error, missing, or imply design or implementation. In that regard, keep the following in mind:

The L3 (F&PRS) requirements were written when an implied architecture was assumed. This created a situation where some of the L3 RBRs require extensive clarification text that would justify the (apparent) mismatch in functionality of the L4s traced to the L3 RBRs. The use of **"req_interpretation"** text should capture this clarification text and be used to give better information to the designer, tester, and reviewer (internal or external) of the system.

"req_interpretation" must describe the cumulative interpreted capabilities for that release, not incremental changes. Clarification text must be written so that it is clear whether the text modifies only a part of the RBR, or interprets the meaning of the entire RBR. Accordingly, the clarification text must be written in one of the following ways:

a. Describe the cumulative interpreted capabilities of the entire RBR in complete sentences.

b. Describe exceptions to what is stated in the RBR with text beginning "Exceptions: ", followed by one or more complete sentences

c. Clarify (under part of the RBR) with text beginning with "Clarification: ", followed by one or more complete sentences that describe the clarification and clearly indicate which part of the RBR is being clarified. In addition, consider the following when writing the clarification:

F&PRS

EOC-8370 The EOC shall generate at a minimum the following:

a. Security Audit Log
b. EOC Resource Utilization Report
c. EOC Status Report
d. EO Hardware/Software Configuration History

L3RBR

EOC-8370#A (Rel A) The EOC shall generate at a minimum the following:

a. Security Audit Log
b. EOC Resource Utilization Report

EOC-8370#B (Rel B) The EOC shall generate at a minimum the following:

a. Security Audit Log
b. EOC Resource Utilization Report
c. EOC Status Report
d. EO Hardware/Software Configuration History

Figure 6.2.1 Example L3 F&PRS to L3 RBR Conversion

F&PRS

EOC-5090 The EOC shall perform the necessary engineering unit conversion, derived parameter generation , and digital and discrete state determination on the decommutated housekeeping data.

L3RBR

EOC-5090 (Rel A) The EOC shall perform the necessary engineering unit conversion, derived parameter generation on the decommutated housekeeping data.

EOC-5090 (Rel B) The EOC shall perform the necessary engineering unit conversion, derived parameter generation, and digital and discrete state determination on the decommutated housekeeping data.

Figure 6.2.2 Another Example of L3 RBR Format

Describe how implied functionality should be addressed in the L4s and how integration and test needs to interpret the L3 RBR for testing purposes on that Release.

The **"req_interpretation"** text must not assume or reference functionality described in the previous release's "req_interpretation" text. Also, it must not have the form of a Level 3 requirement written to conform to the new ECS architecture (i.e., requirements should be architecture independent).

Rather than repeat SOW or mission specific information (e.g., which DAACs are active, what instruments are valid, etc.) in each RBR **"req_interpretation"** text, a general statement will be added to DID 304 when published to preface all L3 RBRs for that release with respect to mission specific characteristics that will be tested. Only exceptions to the general note against that Release should be noted in the "req_interpretation" text.

Please note that the original intent of the **"req_interpretation"** text associated with the L3 RBRs was to help the readers (both internal - test organization and L4 authors - and external - IV&V) understand how the L3 functionality was being partitioned into RBRs and give insight into why the present L4s allocated will reflect "derived" functionality that may influence System testing against the L3 RBRs from Release to Release. It was not intended to give an explanation as to why a particular L4 was allocated to the L3 RBR.
It should also be noted that the **"req_interpretation"** text changes that occur (due to CCRs) will have its history maintained, just as the requirements text and other attributes of each RTM Class' history is maintained.

The **"functionality_status"** attribute in the L3 RBR Class has special significance for tracking the RBR from Release to Release. It is used to understand what functionality exists against what L3 requirement in different Releases as the system is incrementally built through the Releases. It is an indicator for test organization to recognize partial or full functionality that needs to be tested on a given release. It indicates whether or not new functionality is to be implemented in this release and indicates whether or not the parent Level 3 requirement is to be fully implemented in this release. Table 6.2-1 defines the allowable values for the **"functionality_status"** attribute:

Value	**Figure 6.2.3-1 Table Code**	**Definition**
TBD	**T**	To Be Determined
Partially Met	**P**	The full L3 is not met on this Release.
All Functionality Complete	**C**	There was partial functionality on a previous Release and on this Release the full L3 (F&PRS) functionality is met.
Fully Met	**F**	This is the first Release that this L3 (F&PRS) requirement has appeared and it fully meets the L3 (F&PRS) requirement in this Release.
No New Functionality	**N**	Indicates that the previous Release functionality (either partial or full) is not being modified in this Release (e.g., no new L4 requirements against the L3 RBR).

New Implementation	**I**	Indicates that the previous Release functionality remains identical (e.g, no new L4s), but due to a modification to the design or new COTS product (or upgrade) there is implied testing that must be redone in order to validate functional or performance requirements previously met.

Table 7.2-1 Functionality_Status Attribute Values Code Definitions

L4 Release	L3 RBR Release				
		A	B	C	D
I	F	N	N	N	
IA	P	C	N	N	
IB	P	N	C	N	
A		F	N	N	
AB		P	C	N	
AC		P	N	C	N
B			F	N	
BC			P	C	N
BD			P	N	C
C				F	N
D					F

Note:
I = Ir1 Release

Figure 6.2-3 "Functionality Status" Attribute Value Decision Table

6.3 L4 Requirements Class Explanation

The L4 Requirements (i.e., Subsystem requirements typically at the CI level) are derived from the L3 RBRs and are designated by Release. Only a single Release is allocated to an L4. The Release designation is the first Release in which the functionality is provided and should, therefore, eventually be traced to the same first Release L3 RBR. All L4s must be linked to their parent L3 RBR in the RTM database.

A partial decision table, in Figure 6.2-3, presents examples of most of the common combinations for the “functionality_status” attribute; the "letter" codes listed in the table are defined in Table 6.2-3.

For example: If there exist Level_4 children of a given RBR in releases Ir1 and A (second row in the decision table) then the code for the functionality_status of that RBR in Ir1 is ÒP", for release A code ÒCÓ, and code ÒNÓ for release B.

6.4 Traceability of L3 RBRs to L4 Requirements Class

In order to check traceability and allocation of L4 requirements, the Release attribute for the L4 requirements must be selected. It is assumed, once a L4 requirement has been allocated to a Release, it is applicable to all later Releases, unless, of course, the ECS CCB has agreed to eliminate the functionality. If new development or new COTS implementation is required for later Releases, the trace to the subsequent L3 RBR must be annotated with a "new implementation" value for the "functionality_status" attribute of the RBR. This gives the test organization valuable information to plan their test and integration program. When tracing L4s to L3 RBRs, note that all previous Release L4s that were traced to previous release L3 RBRs now need to be also traced to the present and future Releases of the same L3 RBR. Again, exceptions may exist to this rule: for instance, a L4 requirement may go away after an earlier Release and would, therefore, not be traced to a later Release; this is demonstrated in the example shown in Figure 6.4-1.

Each release organization is responsible for identifying the links between its own RBRs and the L4s. Typically, individual L4s will be linked to RBRs in multiple Releases (as shown in Figure 6.4-1). A L4-RBR link is identified with the release of the RBR; not uniquely by the Release attribute on the L4.

Note that traceability (or linkage) between a L4 and the L3 RBR is maintained only against the most "current version" of the L4 or L3 RBR as shown in Figure 6.4-2. This is also applicable to links from the requirements to the "CCR" Class in RTM. Attempting to archive links between deleted or replaced requirements would become very cumbersome and was not implemented for the ECS Project.

If a L3 RBR has a **"req_type"** attribute value of "procedural", it (typically) will not require traceability to a L4 requirement. A "procedural" type L3 RBR usually means that the L3 RBR is referring to design standards or non-functional requirements that are verified in a different manner than being traceable to a specific design component (through the L4 traceability). The **"req_interpretation"** text must be filled in for this type of requirement, which will give the reader insight into how this L3 RBR will be met (e.g., "see Whitepaper XXX", "see DID 515 for details on verification", "standards being followed are documented in DID 305", etc.).

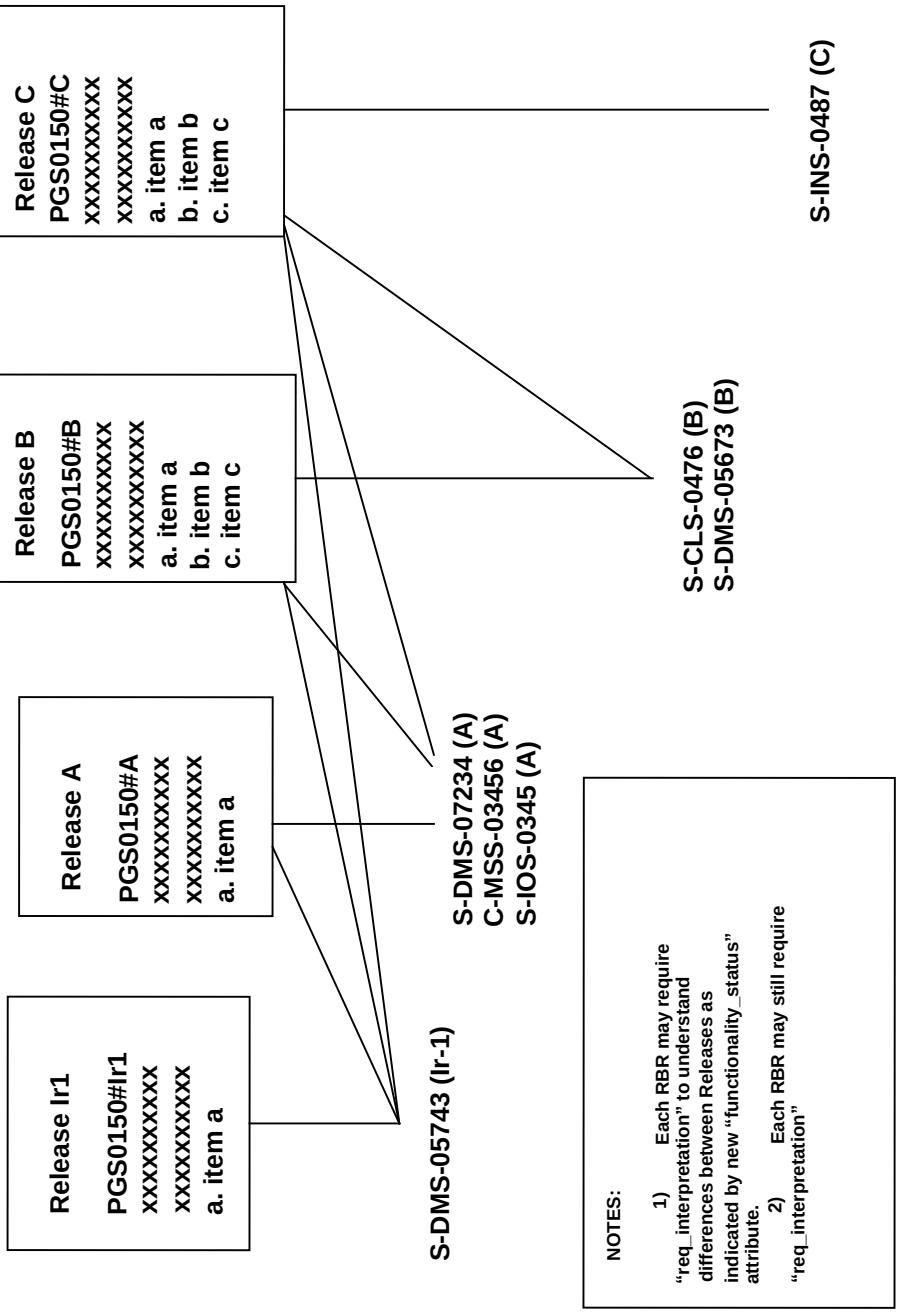


Figure 6.4-1 L3 RBR Class Linkage Organization

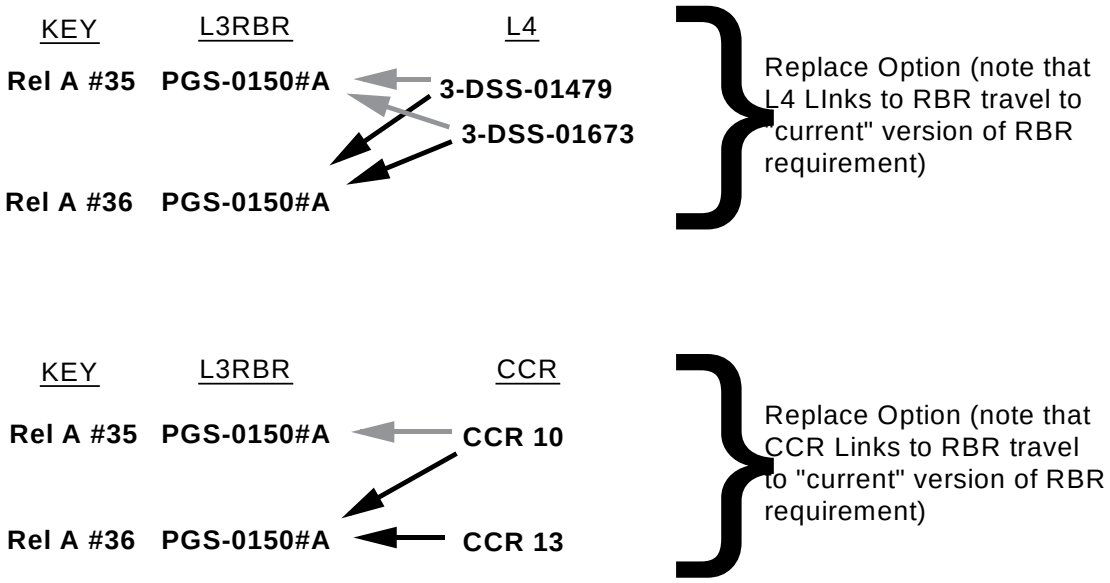


Figure 6.4-2 RTM RBR Update Results

7.5 Traceability of L4 Requirements to Component Class

All L4 requirements need to be traced to the Component Class. The Component class contains the design implementation on a Release-by-Release basis. The Component Class is the basis of the contract requirement for a Configuration Items List (see the Component class attributes for further information). To ensure that identical L4 requirements, that are implemented differently in different Releases, is captured properly in RTM, there must be another instance of the component in the Component Class (using a unique ID) to trace from the same L4 requirement to a new implementation in a later Release.

6.6 Acceptance Test Class (To be Supplied)
6.6.1 AT_A Class (To be Supplied)
6.6.2 AT_B Class (To be Supplied)
6.7 System & Integration Test Classes (To be Supplied)
6.7.1 IT_IR1 Class (To be Supplied)
6.7.2 IT_A Class (To be Supplied)
6.7.3 IT_B Class (To be Supplied)
6.7.4 IT_FOS Class (To be Supplied)
6.8 CCR Class (To be Supplied)
6.9 Guidelines for Mapping Between RTM Classes (To be Supplied)
6.9.1 L4 to RBRs (To be Supplied)
6.9.2 IRDs and Mapping to ICDs (To be Supplied)
6.9.3 Subsystem and Mapping to L3 F&PRS (To be Supplied)
6.9.4 Acceptance Test and Mapping to L3 RBRs (To be Supplied)
6.9.4.1 AT_A to RBR (To be Supplied)
6.9.4.2 AT_B to RBR (To be Supplied)
6.9.5 System & Integration Test and Mapping to L3 RBRs (To be Supplied)
6.9.5.1 IT_IR1 to RBR (To be Supplied)

6.9.5.2 IT_A to RBR (To be Supplied)
6.9.5.3 IT_B to RBR (To be Supplied)
6.9.5.4 IT_FOS to RBR (To be Supplied)
6.9.6 Component and Mapping to L4s (To be Supplied)
7.0 Methods for Implementation of Approved RTM CCRs
7.1 Creating Queries (To be Supplied)
7.2 Attribute Changes (To be Supplied)
7.3 Bulk Links (To be Supplied)
7.4 Bulk Loads (To be Supplied)

PART IV: Process Instruction for Each Key Process Role

8.0 Originator

The Originator is the person responsible for beginning the CCR process and is normally the person who identifies the need for a change. The scope of the change can range from a single requirement to many requirements and associated links. It is critical that the Originator understand the ECS requirements as well as how the RTM tool manages these requirements. Anyone who is not trained in ECS RTM schema or not knowledgeable of RTM query procedures, should *not* act as an Originator.

An Originator of a CCR must be cognizant of the affects that the recommended CCR changes will have on dependent classes. Querying the requirements in RTM correctly and completely is the only way to catch these kinds of critical errors that may come about because of CCR changes. In other words, an Originator can unknowingly do *damage* to RTM while attempting to *fix* the data. (Note: There is a RTM training class and associated documentation -- including this one-- that can help a potential Originator learn RTM.)

The manner in which the Originator prepares the CCR sets the tone for the integrity of the data throughout the preceding three phases-- approval, implementation, and closure. The Originator should be careful to coordinate any possible impacts to other organizations that might result from the CCR being created. ***The Originator should be also aware that by requesting the deletion of a requirement or link, an associated requirement can become an orphan. Since RTM stores the ECS baseline version of the requirements and design, inadvertently creating orphan requirements will cause customer concern due to lack of traceability.***

The steps below are taken directly from the RTM CCR change process outlined in section 1.2. The proceeding text provides a view of the activities/steps that the Originator is exclusively responsible for in his/her role.

Step 1 (Phase 1, Step 1): The Originator identifies the need for a requirement modification.

Step 2 (Phase 1, Step 2): The Originator should contact CMO to schedule a preview presentation to the CCB. This presentation outlines the scope of the change and estimates the effort needed to investigate and recommend resolution. If the change is deemed valid, the CCB assigns an action item to create a CCR along with a projected board date.

Step 3 (Phase 1, Step 3): The Originator develops the Originator Query Set from the current baseline version of RTM. The first step is 'generating the Query Statement and querying the current RTM baseline' to extract those requirements subject to modification as addressed in the preview presentation. The Originator includes a copy of the query statement with the CCR package for reference. The ECS RTM User Training Documentation and/or the RTM User Manual provides the necessary information for creating queries.

Once the requirements are extracted from RTM into a report, the Originator determines the recommended change for each requirement.

Step 4 (Phase 1, Step 4): After carefully reviewing the RTM reports produced in the previous step, the Originator edits the RTM reports to reflect the exact changes that are required. The instructions for editing and formatting given in Section 1.4 must be followed (see section 13.2 for examples). The Originator includes a copy of the changed tables with the CCR package.

The Originator must generate the RTM report in rtf (rich text format) to facilitate importing it into a Word table for Excel spreadsheet. Then sort the information into two kinds of tables:

a. Attribute change tables (A separate table should be created for each RTM class that requires a text attribute change).
b. Link change tables (A separate table should be created to add and/or delete links between classes (group the additions and group the deletions within the table)).

To mark desired changes, use the following instructions:

a. Use the underline function in Word or Excel to highlight additions.
b. Use the strike-out function in Word or Excel to highlight deletions.

IMPORTANT: If the original data is being replaced, the original data must still appear in the report with a strike out. If the change is an addition, the original data must still appear. This is a key to adequate CCB review and to RTM data modification accuracy.

Step 5 (Phase I, Step 5): The final step in Phase I is to prepare the paperwork to be delivered to CMO for submittal to the ECS CCB. This package should be submitted to CMO in electronic form to the ECS cc:mail address ECSCM. A hardcopy of the CCR form should be signed by the Originator and the OriginatorÕs office manager and delivered to CMO. The CCR should be turned into the CCB 10 days prior to the desired CCB date, which was scheduled at the time of the preview presentation. The package should include the items provided in Table 1.2.1-1.

Step 6 (Phase II, Step 4): The CCR will be entered into the "Pending Requirements Change Report (PRCR)" by CMO, and if a match is found it will be the responsibility of the originator to research the related pending CCR. Once the conflicts are identified, the originator is responsible for contacting the originator(s) of the impacted pending CCRs affecting the same requirement. All conflicts must be resolved prior to the CCB date.

Step 7 (Phase II, Step 5): After identification and resolution of impacts to the CCR, the originator must edit the change recommendation table to reflect any new findings.

Step 8 (Phase II, Step 6): Once the originator makes all necessary corrections (if any) the CCR is then presented to the CCB for review and approval. The revision may have to be posted for further CCB review before disposition.

9.0 Coordinator

The Coordinator is assigned by CCB when the CCR is approved. For purposes of continuity and technical accuracy, it is best when this person is the Originator. However, there are cases where someone else is assigned this role.

The Coordinator is the key contact person that pushes the CCR through the implementation and closure phases. This person is in constant contact with the RTM administrator, the RTM DBA, CMO, and the Quality office regarding the status of the CCR.

The Coordinator should prepare a 'working folder' for the CCR to be carried from one implementation activity to the next. This folder will be used by the RTM Support Personnel who will make notes as the RTM data modification process is taking place. The QO person will then use the folder to make discrepancy notes. Finally, once QO is satisfied with the implementation, the associated paper work will be brought by the Coordinator to the CMO office and RTM administrator for official closure.

Ensuring the proper completion of the RTM form by all parties throughout the process is the responsibility of the Coordinator.

The steps below are taken directly from the RTM CCR change process outlined in section 1.2. The proceeding text provides a view of the activities/steps that the Coordinator is exclusively responsible for in his/her role. (Note: the Originator may need to be called back in the process for technical questions)

Step 1 (Phase III, Step 1): The Coordinator works with the SMO RTM Administrator to schedule the implementation of the approved CCR into the RTM database.

Step 2 (Phase III, Step 2): Once an approved copy of the CCR is received from CMO, the SMO assigns the RTM Support Personnel to enter the requirements changes specified by the CCR.. The coordinator should work closely with the RTM Support Personnel and be available for any questions.

Step 3 (Phase III, Step 6): As soon as the RTM data modification is complete, the Coordinator notifies CMO via cc mail address ECSCM that the task is complete. CMO immediately updates the CCR status to “Input Complete” in the RTM CCR class. The Coordinator forwards the CCR

package to QO for verification. The package should include the same items as the initial CCR package as well as a copy of the change table with the RTM Support Personnels' notes.

Step 4 (Phase IV, Step 3): Following QO verification, if changes are needed the CCR will be sent back to the Coordinator for further data modification by RTM Support Personnel. Once completed, the CCR folder is returned to QO for reverification.

Step 5 (Phase IV, Step 5): Once the Coordinator receives the CCR package with the QO signed RTM change form, the closure process can begin. The Coordinator initiates the closure process by doing the following:

a. Forwards the complete CCR package to CMO.

b. Notifies the RTM DBA to revoke RTM data modification authorization.

c. Notifies the RTM SMO Administrator that the database is ready for new CCR RTM data modification.

10.0 CMO

The steps below are taken directly from the RTM CCR change process outlined in section 1.2. The proceeding text provides a view of the activities/steps that the CMO is exclusively responsible for in their role.

Step 1 (Phase I, Step 2): CMO schedules the preview presentation to be given by the originator to the ECS CCB. An action item will be assigned by CMO, to the originator to create a CCR based on the valid requirements changes presented to the CCB, along with the projected board date. The CCB schedules the CCR to assure that all work can be done against a single baseline and deltas between submittal and implementation are kept at a minimum.

Step 2 (Phase II, Step 1): Once CMO receives the CCR package from the Originator, it will:

a. Assign a CCR number and add the number to all of the items in the CCR package.
b. Place the CCR on an ECS CCB meeting agenda.
c. Link CCR No. To its driving Action Item (See Figure 1.2.1-1)

Step 3 (Phase II, Step 2): CMO then posts the CCR with its RTM Change Table and associated forms (reference phase 1 step 5) to the ECS CCB bulletin board (URL http://dmserver.gsfc.nasa.gov/CCB-BB/ECS/rtmrvdex.html) for review prior to the CCB meeting date. (per timetable in PI CM-1-004).

Step 4 (Phase II, Step 3): CMO enters the requirements affected by the CCR in the “Pending Requirements Change Report (PRCR)”. If a requirement that is recommended for change in the CCR is also requested to be changed in another CCR that is pending the tool will flag this as a conflict. CMO will inform the originators of each conflicting CCR, by cc:mail that there is a potential conflict with another pending CCR. The pending tool is further defined in section 1.3.2.3.

Step 5 (Phase II, Step 7): When the ECS CCB approves the CCR, it will issue an action item that sets a completion date and assigns a coordinator to manage the CCR implementation, managing the work flow through completion of the process.

Step 6 (Phase II, Step 8): As soon as the approval signature is obtained, CMO distributes copies of the approved CCR to the following:

a. The newly assigned CCR Coordinator
b. The RTM Database Administrator (DBA)
c. SMO RTM Administrator

Step 7 (Phase II, Step 9): CMO adds CCR metadata to the RTM CCR class. In the CCR class, each CCR is assigned a record. All of the requirements that are affected by the CCR will be linked to this record after the RTM data modification is complete. It should be noted that whenever a requirement is deleted under a CCR the requirement should be listed in the clarification text. This is necessary because deleted requirements can not be linked. The CCR RTM attributes that must be filled out in RTM are:

a. CCR title
b. CCR Originator
c. CCB Name
d. CCR approval date
e. CCR ID
f. CCR Revision
g. Entry Status
h. GSFC CCR and contract mod information if applicable

Step 8 (Phase III, Step 6): CMO updates the status in the RTM CCR class, following notification from the Coordinator that RTM data modification is complete.

Step 9 (Phase IV, Step 8): When CMO receives the completed package with QO's signature, the CCR is officially implemented and can be closed. The following events must take place:

a. RTM CCR Class is updated to QA Completed Status.
b. CMO verifies that RTM DBA has revoked RTM data modification authorization.
c. The CCB's CCR Implementation action item is closed.
d. CMO adds the list of deleted requirements to the clarification text of the CCR class.
e. The CCR is closed in the CCR tracking system.
f. The CCR closure is reported with the next Baseline documentation.
g. The CCR is removed from the Pending Requirements Change report at the next baseline.

11.0 QO.

The steps below are taken directly from the RTM CCR change process outlined in section 1.2. The proceeding text provides a view of the activities/steps that the Quality Office is exclusively responsible for in their role.

Step 1 (Phase III, Step 6): As soon as RTM data modification is complete, the coordinator will forward the CCR package to QO for verification. The package should include the same items as the initial CCR package as well as a copy of the change table with CCR Implementor's notes, which QO should review.

Step 2 (Phase IV, Step 1): At this point in the process, it is important to obtain a current time-stamped snapshot of the database. QO queries RTM for present post-RTM data modification condition. QO will run the QO Query to be compared to the Originator Query Set from Phase I to verify the CCR implementation. In some cases QO will determine it preferable to write its own query.

Step 3 (Phase IV, Step 2): QO verifies the proper implementation of the CCR.

a. QO will use the approved CCR change table along with the QO query to verify the implementation of the CCR.
b. QO will verify the links to the CCR class
c. QO will review the requirements directly in the tool to identify discrepancies.
d. O will document any identified deficiencies and provide a list to the Coordinator for resolution. This list should be added to the CCR package for reference.
e. If any impacts require action outside the scope of the CCR, QO will note the impact as an action on the RTM form.

Step 4 (Phase IV, Step 4): QO signs the RTM Change Form and forwards the CCR package to the Coordinator.

12.0 RTM Data Modification Instructions

No RTM data modification work is to be done without an approved ECS CCR. The coordinator of the CCR will assign the RTM Support Personnel. Once the RTM Support Personnel are assigned, the coordinator will schedule a time slot for RTM data modification with the RTM Administrator and obtain access through the RTM DBA.

All RTM data modification will be done serially with only one person having access per class. Therefore, it is important to have RTM installed and ready to go once change access to RTM is given. (It can take a couple of days to get RTM installed and running on the PC or MAC for the first time.)

Once RTM is available, the RTM Support Personnel must be given read/write access to the specific class addressed in the approved CCR. It is responsibility of the Coordinator to schedule

the RTM data modification time with the RTM Administrator. Meeting maker will be the tool used to view access to RTM.

The RTM Support Personnel must go through the following four steps:

a. Make all attribute changes from text change table of the approved Change Table Set

b. Make all link additions/deletions from the link table of the approved Change Table Set

c. The RTM Support Personnel must go back and proof all work in RTM. This is a critical step. It is important that the coordinator allow time for this check. QO will be focusing on the verification of the change as a priority rather that the verification of the change. It is important that the work is as accurate as possible.

d. Create links to the CCR Class.

12.1 Logon to RTM

The instructions for logging onto RTM can be found on the "RTM" cc:Mail Bulletin Board. The instructions describe the logon procedures for the PC, Mac, and workstation.

12.2 Format of the Change Table(s)

The RTM change table format must be consistent with the standard format to avoid RTM data modification interpretation difficulties. All change tables should follow the same format style to increase the clarity of the requested change. It is also important that the RTM Support Personnel be given a copy of the change table rather than the original paperwork. Clarifying notes or questions can be made on the copy by the RTM Support Personnel.

There are two types of changes, 1) Text change table-- changes to attributes *within* a specific RTM class and 2) Link change table-- creating and breaking links *between* RTM classes.

The headings for the tables should provide the following information:

a. The "title" of the query
b. The CCR #
c. The date of the Baseline version of RTM used to create the query
d. The actual date the query was run
e. Include page numbering at the bottom

Text Change table

The approved CCR change table given to the RTM Support Personnel should have the following minimum attributes per affected class:

paragraph_id
req.key
req.text
req. interpretation

The table should also include any attributes in addition to these that are approved to be changed. The requested changes should be highlighted in the following manner: All additions must be added to the corresponding attribute and underlined. Any deletions from an attribute must be ~~struck out~~. The same rule must be applied for creating and deleting links.

Table 12.2-1 below, is an example of an attribute change table for additions/deletions to attributes within a class. The table is giving the instructions to add req_interpretation text to SDPS0010 and to remove the req_interpretation from PGS0120 in class L3_FPRS.

paragraph_id	req.key	req. text	req.interpretation
SDPS0010	2	The SMC shall perform fault analysis including, at a minimum: a. Isolation b. Location c. Identification d. Characterization	Semi-automated or automated
PGS0120	3	The PGS shall base the PGS reprocessing plan on, at a minimum: a. Requests received from IMS b. SMC directives c. The standard	~~Semi-automated or automated~~

Table 12.2-1 Attribute Change Table Example 2

Link Change Table

Changes to Links should be illustrated in a link change table that is divided by 'links to be added' and 'links to be deleted.' (see example table below)

Add the following links between RBRs and L4s

PGS-0000#A	C-CSS-00002
PGS-0001#Ir1	C-CSS-00002
IMS-0003#B	C-CSS-00003

Delete the following links between RBRs and L4s

PGS-0000#Ir1	C-CSS-00002
IMS-0001#A	C-CSS-00003

12.3 Procedure for Changing a Requirement in RTM

a. Log into RTM

b. Once the RTM Window pops up, Set RTM Project Name to MAIN.

c. Using right mouse button click in the center of the window.

d. From the pop up menu choose Requirement Engineering: Requirement Editor.

e. Once the Requirement Editor window pops up, select the Requirement Class highlighted in the CCR.

f. On the menu bar, pull down Requirement menu and select Load by Paragraph ID. At this point, enter in the requirement that is being changed.

g. Once the requirement is retrieved, there will be a prompt to select which key number. The current key is normally the highest key number.

h. Make the changes to the requirement.

i. On the menu bar, pull down Requirement menu and select Store Replacement.

j. Record requirement key – once the requirement is "stored" a pop up menu will provide the new requirement key. It is important to record this number on the hard copy of the change table.

12.4 Procedure for Creating or Changing a Link

Links can be made both manually or by a batch program. See the RTM Training material first, then if necessary, ask the RTM DBA or the RTM administrator how to run the batch program.

12.5 Proofreading

After all changes are made, the RTM Support Personnel are required to go back requirement by requirement and check his/her own work. The Coordinator must allow the RTM Support Personnel the time needed to perform this task.

13.6 Creating Links to the CCR Class

Links must be created from every requirement changed to the CCR in the CCR class which authorized the change. If the change is an attribute change only, then link that paragraph_id to the CCR_id in the CCR class which authorized the change. If the change is a deletion/ addition of links between classes, then the CCR link should be made to the parent requirement where a link change occurred.

By using the approved change tables, the paragraph_id can be cut & pasted into an automated link table. The current instructions for automating links can be found in Section 8.3.

Either the RTM Support Personnel or the Coordinator can create these links. It is ultimately the responsibility of the Coordinator to have the links created and QA'ed.

APPROVAL

_____

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_____

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